CHAPTER 6
OPERATION OF PGS
LESSON PLAN 6

METHOD:

Conference, demonstration, and practical exercise

TIME ALLOTTED:

3.0 hours

COURSE PRESENTED TO:

a. LAV-25 crews
b. Instructors
c. TAVSC personnel

TOOLS, EQUIPMENT, AND MATERIALS:

See Appendix A

PERSONNEL:

a. Primary instructor
b. Assistant instructor

INSTRUCTIONAL AIDS:

a. Overhead projector
b. Viewgraphs (Appendix D)

REFERENCES:

a. TM 08594A-12&P
b. TM 08594A-10/1A

APPENDICES:

Appendix A. Tools, Equipment, and Materials
Appendix B. Safety
Appendix C. TDRS Memory Card Setups
Appendix D. Viewgraphs

6-1. INTRODUCTION. (5 minutes)

Note. Show Slide 1.

a. **Reason**. PGS was designed to provide LAV-25 crews with a training device to conduct precision gunnery and force-on-force training. To use PGS to its full potential, you must know how to operate the four training modes of PGS.

Note. Show Slide 2.

b. **Training Objective**. Given LAV-25 with PGS installed and aligned, the crew will demonstrate the following exercises:

(1) Panel gunnery
(2) Combat mode (force-on-force)
(3) Scaled gunnery
(4) Tracking training

c. **Procedure**. During this block of instruction we will cover the operation of PGS during training. The classroom portion of this class will cover important operational functions of PGS to consider during training. Each vehicle crew will have an assistant instructor for the practical portion of this class.

6-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISES. (140 minutes)

Notes. 1. The primary instructor will release the student crews to their assigned assistant instructors for the practical exercise portion of this lesson.
2. Show Slide 3.

a. **PGS Training Modes.** PGS provides several modes of training that can be used for various types of exercises. The following training modes can be selected:

(1) **Panel gunnery.** Panel gunnery is conducted with panel targets, equipped with retro reflector units and/or LTIDs.
(2) **Scaled gunnery.** Panel gunnery can be conducted with 1/10 or ½ scale targets. This provides long range gunnery training in ranges and training areas that do not have the desired distances.
(3) **Combat mode (force-on-force).** This training mode can be used with other TWGSS/PGS/MILES-equipped vehicle/systems and retro reflector units.
(4) **Tracking training.** The system provides manipulation training with the use of tracking training mode.

Note. Show Slide 4.

6-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISES (Con't).

b. **Transparency During Training.** PGS is designed to be fully integrated with the LAV-25 fire control system. The crew is required to perform the same gunnery procedures as required during live fire gunnery.

Note. Show Slide 5.

(1) **BOT/TOT capability.** The burst on target can be used to adjust firing during target engagements.
(2) **Correct range.** To successfully engage a target, the gunner must apply the correct range for each ammunition fired in order to hit the target.
(3) **Correct lead.** The correct lead for each ammunition type must be applied to hit a moving target or if firing on the move.

Note. Show Slide 6.

c. **TBOS Effects**. Visual effects of firing AP, HE, and coax are simulated in the gunner's and commander's sight in day and thermal modes. The effects simulated are:

(1) **Tracer simulation.** The tracer of AP, HE, and every fifth coax round are simulated. The correct burn time of each ammunition type is preprogramed.
(2) **Burst simulation.** Burst on target and ground burst are simulated. Ground burst effects are smaller than target hit burst effects. The burst size is ammunition and range dependent.

Note. Show Slide 7.

d. **Tracer Template.** The visual effects of the TBOS simulation are controlled by a template. The following happens with TBOS effects when firing in the different areas.

Note. The panel gunnery template is a BMP frontal for AP and HE, and a kneeling soldier for coax. Combat gunnery will use a 3m high and 4m wide template.

(1) **Area A.** If area A is hit, tracer simulation is stopped. A burst on target indication is given. Burst on target indication is bigger than burst on ground indication.
(2) **Area B.** If area B is hit, tracer simulation is stopped before reaching target and burst on ground indication is given at the impact point between projectile and a simulated ground plane.
(3) **Area C.** If area C is hit, tracer simulation continues until the simulated projectile reaches maximum simulated range (if this happens before a ground hit) or hits the simulated ground plane.

(4) **Area D.** If area D is hit, tracer simulation stops at the top of the template or simulation continues (with tracer simulation switched off) until the ammunition reaches maximum simulated range or hits the simulated ground plane.

Note. Show Slide 8.

e. **Ammunition Simulation.** The LAV-25 ammunition is simulated to the following ranges:

Note. Burst indication will be presented independently of tracer burnout.

(1) AP has a maximum simulation range of 3000 m with tracer burnout at 1700 m.
(2) HE has a maximum simulation range of 3000 m with tracer burnout at 2000 m.
(3) COAX 7.62 ammunition has a maximum simulated range of 1100 m with tracer burnout at 900 m.

Note. Show Slide 9.

f. **Result Presentation.** PGS has the following capabilities.

(1) **Graphic presentation.** This is used for exercises where the presentation of the impact point in relation to the target outline is more important than numerical presentation.
(2) **Numerical presentation.** This is used during exercises where immediate feedback is needed.
(3) **Result presentation OFF.** When conducting panel gunnery or combat mode (force-on-force) exercises where the crew should not see the firing results until after the exercise, the instructor can turn off the result presentation in the control panel. Target results are still displayed. The results are still stored on the TDRS memory card for AAR.

g. **Results Provided by Control Panel.** The system provides both the results from engagements where a vehicle has fired and where a vehicle has been fired upon.

Note. Show Slide 10.

(1) **Fire result.** Elevation and azimuth impact point on the target is shown in relation to center of mass. The results are provided in meters with the resolution of 0.1 m. The actual range to the target is also provided together with an engagement evaluation.

Note. Show Slide 11.

(2) **Target result.** Elevation and azimuth impact point on the vehicle is shown in relation to center of mass. The results are provided in meters with the resolution of 0.1 m. The aspect angle and effect on the vehicle are also provided on the display screen.

6-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISES (Con't).

Note. Show Slide 12.

h. **Engagement Result.** The control panel presents an evaluation of the engagement together with the actual hit coordinates and ranges to target. The following results are possible.

Notes. 1. MILES message is sent at the impact point of the round.
2. MILES codes used for PGS are IAW the enhanced MILES code structure.

(1) **HIT.** The simulated round hit the target. The simulator assumes the target is either a BMP frontal for AP and HE or a kneeling soldier for 7.62 mm coax rounds. If the control panel indicates a HIT, a MILES code is sent to impact point to allow the LTID to drop.

(2) **GROUND HIT.** A ground hit occurs if the ammunition falls short of the maximum range simulated for that ammunition type or falls short of the target. A ground hit is presented with the range of the actual ground impact. MILES code is also sent to ground impact point.

(3) **MAX RANGE.** If maximum range is indicated on the control panel, the round fired did not pass a target with a retro reflector unit within the field of view of the transceiver unit.

Note. Show Slide 13.

i. **Sound Indications.** The system uses sound to alert the crew that different events have taken place. The sound indications can be divided into firing system and target system sound indications.

(1) **Firing system sound indications.** For the firing of ammunition the following sound indications are heard through the vehicle intercom:

(a) Firing of the 25 mm gun
(b) Firing of the coax gun

(2) **Target system sound indications.** When PGS is fired upon from other simulator-equipped vehicles, the vehicle intercom indicates the following to the crew:

(a) NEAR MISS = 2 tones. If the LAV-25 had a near miss, the vehicle intercom indicates with 2 tones followed by a voice command of "NEAR MISS".
(b) HIT (no kill) = 4-6 tones. If the LAV-25 is hit by a round but not killed, the vehicle intercom indicates with 4-6 tones followed by a voice command of "HIT".

Notes. 1. In combat mode, a killed LAV-25 must be restored with the CGUN. The ammunition load is returned to the pre-programmed amount.
2. If the LAV-25 is killed during panel gunnery, the target system autoactivates after 5 seconds and the kill indications stop. The ammunition load is returned to the pre-programmed amount.

(c) KILL = continuous tone. If the LAV-25 is hit and killed, a voice command of "KILL" followed by a 30-second continuous tone is heard in the vehicle intercom. A kill tone is also indicated if CGUN KILL is transmitted to the vehicle.

Notes. 1. WEAPON KILL and MOBILITY KILL are also indicated with 4-6 tones followed by a voice command of "WEAPON KILL" or "MOBILITY KILL".
2. Show Slide 14.

j. **Target System Visual Indications.** The target system effects are indicated by the strobe lights in the retro detector units (RDUs). The following visual indications are given by the target system:

(1) **NEAR MISS = 2 flashes.** If the target system calculates a near miss, the RDU strobe lights flash 2 times.
(2) **HIT = 4-6 flashes.** If a the target system calculates a hit, the RDU strobe lights flash 4-6 times.

Notes. 1. If the LAV-25 is killed during panel gunnery, the target system autoactivates after 5 seconds and the kill indications stop. The ammunition load is returned to the pre-programmed amount.
2. In combat mode, a killed LAV-25 must be restored with the CGUN. The ammunition load is returned to the pre-programmed amount.

(3) **KILL = continuous strobe light flashing.** If the target is killed by a round or a CGUN, the RDUs strobe lights will flash continuously. This indication will continue until the system is reactivated.

Notes. 1. WEAPON KILL and MOBILITY KILL are also indicated with 4-6 strobe indications.
2. Show Slide 15.

k. **Target System HIT Functions.** PGS simulates four different types of vehicle hits. It is important the crew reacts properly to each type.

Note. During force-on-force exercises, the vehicle commander must take the correct action for the type of hit indicated on the control panel.

(1) **HIT.** The vehicle has been hit but not damaged and can continue to fight.

Note. MOBILITY KILL will only be indicated if the drive train has been hit.

(2) **HIT with MOBILITY KILL.** The vehicle has been damaged and immobilized. If a mobility kill is indicated, the crew must stop within 30 seconds or the vehicle will be permanently killed. During a mobility kill, the crew can continue to engage targets from a stationary position.

Note. WEAPON KILL will only be indicated if the gun area or sights are hit.

(3) **HIT with WEAPON KILL.** The vehicle has been hit and the weapon system has been damaged. The vehicle can still maneuver, but ammunition has been removed.

(4) **KILL.** The vehicle has been hit and the target system evaluates the round to have killed the vehicle. The vehicle must be stopped (when the crew considers this action safe) and they must await further instructions.

Note. Show Slide 16.

l. **Tamper During Combat Mode (Force-on-Force) Exercises.** If PGS is tampered with or if something malfunctions, this will be indicated as tamper to the crew. The crew has 10 seconds to correct the failure on the system. If not corrected, PGS will consider itself Not Mission Capable (NMC) for a force-on-force exercise. The following tamper indications are provided:

(1) **Sound indication.** The vehicle intercom informs the crew to check the control panel.
(2) **Tamper pop-up.** A tamper pop-up appears on the control panel display screen to inform the crew that something must be corrected.
(3) **Visual indication.** PGS RDUs indicate with flashes if something is incorrect.

m. **Tamper During Panel Gunnery Exercises.** If PGS is tampered with or if something malfunctions, this is indicated as a BIT error to the crew. A BIT indication removes the capability to fire until corrected. The following indications are provided:

(1) **Sound indication.** The vehicle intercom informs the crew to check the control panel.
(2) **BIT pop-up.** An error pop-up appears on the control panel display screen to inform the crew that something is wrong with the system.
(3) **Visual indication.** PGS RDUs indicate with flashes if something is incorrect.

Notes. 1. The primary instructor now releases the student crews to their assigned assistant instructors for the practical exercise portion of this lesson.
2. Each assistant instructor is to conduct a safety briefing for his group IAW Appendix B.
3. Ensure that TDRS memory card is set up IAW Appendix C for each training mode selected.

6-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISES (Con't).

Warning. Accidental firing of the 25 mm gun could cause injury or death. Ensure the weapon is clear prior to training.

Warning. The moving and operation of vehicle during the practical exercise portion of this lesson must be done under the instructor's supervision.

n. **PGS Operation.** PGS can perform gunnery in four modes: panel gunnery; combat mode; scaled gunnery mode; and tracking training mode.

Note. Ensure that TDRS memory card is set up for panel gunnery mode IAW Appendix C.

(1) **Panel gunnery mode.** Fire on target and verify the following:

(a) Fire AP single shot at each target. Check tracer, ground burst, and burst on target.
(b) Fire HE single shot at each target. Check tracer, ground burst, and burst on target.
(c) Fire COAX at each target. Check tracer, ground burst, and burst on target.
(d) Fire AP low rate at each target. Check tracer, ground burst, and burst on target.
(e) Fire HE low rate at each target. Check tracer, ground burst, and burst on target.
(f) Fire AP high rate at each target. Check tracer, ground burst, and burst on target.
(g) Fire HE high rate at each target. Check tracer, ground burst, and burst on target.
(h) Fire AP until low ammo lamp is illuminated. Check that remaining rounds equal 12 on control panel and that firing is not possible until OVERRIDE is pressed.
(i) Fire HE until low ammo lamp is illuminated. Check that remaining rounds equal 25 on control panel and that firing is not possible until OVERRIDE is pressed.
(j) Fire COAX until low ammo lamp is illuminated. Check that remaining rounds equal 100 on control panel and that firing is not possible until OVERRIDE is pressed.
(k) Fire and verify that results given by control panel are understood.
(l) Check that there is a residual round when selecting between AP and HE.
(m) Verify that the gunner can fire with DRIVE SELECT LEVER in MANUAL and POWER and that auxiliary trigger can be used in MANUAL.
(n) Verify that the commander can select AP/HE, rates of fire, and fire with the DRIVE SELECT LEVER in POWER only.
(o) Select GD (graphics display) on control panel. Fire all ammunition types and verify result presentation.
(p) Use a CGUN to fire KILL, RESET, TEST, and TIME MARK at your vehicle. Verify control panel menus and sound and light indications.
(q) Fire ENABLE CONTROL with CGUN. Upload ammunition manually to turret and hull.
(r) Select DP (display position). Verify control panel displays vehicle position as determined by the remote systems interface (RSI) and NAVIGATE is displayed.
(s) Disconnect left-front RDU. Verify control panel indication. Try to fire.

Notes. 1. Ensure that TDRS memory card is set up for combat mode IAW Appendix C.
2. Use the CGUN to reactivate a target vehicle if killed.

(2) **Combat mode.** Fire on a target vehicle and verify the following:

Note. During combat mode the PGS compensates for the RDU's position.

(a) Select SI (simulation). Fire AP at a PGS-equipped target vehicle. Aim at center of mass and verify that system compensates for retro reflector offset in combat mode (result is approximately 0.0 in. elevation and azimuth).
(b) Verify target NEAR MISS, HIT, and KILL visual indications.
(c) Have a target vehicle crew cover all hull defilade detector units (HDDUs) exposed to firing vehicle. Fire into hull and verify that vehicle is not killed.
(d) Have another vehicle fire at you to verify NEAR MISS, HIT, and KILL indications on control panel, vehicle intercom, and RDU strobe lights.
(e) Fire at the drive train of the target vehicle and verify MOBILITY KILL.

Caution. Do NOT use excessive force when connecting or disconnecting cables.

Note. During tamper demonstration, disconnect RDU for 10 seconds to demonstrate a tamper kill.

(f) Disconnect left-front RDU. Verify control panel indications.

Note. Ensure that TDRS memory card is set up for scaled gunnery IAW Appendix C.

(3) **Scaled gunnery mode.** A target placed at 100 m will simulate 1000 m when 1/10 scale is selected or 200 m when ½ scale is selected. Select 1/10 scale application. Fire and verify the following:

Note. Point out to students that the panel target placed at 100 m must be 1/10 the size or ½ the size of the target it represents, otherwise it will not represent the correct target size for the scale selected.

(a) Verify that all targets are 1/10 or ½ the distance from actual range.
(b) Verify scaled gunnery procedures replicate actual vehicle procedure.

(4) **Tracking training mode.** Tracking training exercises can be performed in panel gunnery mode against targets with retro reflectors installed in the center of mass, or in combat mode against targets with turret-installed retro reflector units.

(a) Vehicle preparations.

6-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISES (Con't).

Notes. 1. Before the start of the training exercise, ensure that the TDRS memory card has been properly set up for tracking training IAW Appendix C.

2. If possible, before the start of the training exercise, prepare a moving target with a retro reflector unit at approximately 500 m away.

(b) Alignment. Perform normal alignment procedures.

(c) Operation of tracking training mode (25 mm gun and coax).

1. Select AP or HE.
2. Set DRIVE SELECT LEVER to POWER.
3. Select MAIN or COAX.
4. When the gunner's or commander's palm switch is pressed, tracking data collection is started.

Note. The crewmember must use the boresight cross as the reticle for tracking training.

5. Tracking data is collected until one the following events occur:

Note. Inform students that trigger activation will provide the tracking result which is stored on the TDRS memory card for AAR.

a. The trigger is activated.

Note. Inform students that if the tracking time elapses, no tracking values will be stored on the TDRS memory card for AAR.

b. The tracking time has elapsed. (Time is selected prior to exercise by instructor).

Note. Inform students that if the palm switch is released, NO tracking values will be stored on the TDRS memory card for AAR.

c. Gunner's or commander's palm switch is released.

Note. Demonstrate AAR of tracking training to the students on the TDRS computer unit.

6-3. FINAL REVIEW. (5 minutes)

a. **Student Questions.**

Note. Show Slide 17.

6-3. FINAL REVIEW (Con't).

b. **Summary of Main Teaching Points.**

(1) Panel gunnery
(2) Combat mode (force-on-force)
(3) Scaled gunnery
(4) Tracking training

Note. Show Slide 18.

c. **Closing Statement.** To get the maximum training value from PGS equipment, you must be able to correctly operate the system in all four training modes.

APPENDIX A
TO LESSON PLAN 6

OPERATION OF PGS

TOOLS, EQUIPMENT, AND MATERIALS

Listed below is the *desired* equipment to obtain the best results for this lesson. (It is understood that some items listed below may not be available at all locations.)

1. LAV-25 with PGS installed
2. TM 08594A-12&P
3. BMP frontal target with target lifter placed at 800 m
4. Infantry (coax) target with target lifter placed at 300 m
5. 1/10 scale or ½ scale BMP frontal target with target lifter placed at 120 m
6. 1/10 scale or ½ scale infantry target with target lifter placed at 60 m
7. Retro reflector unit (one for each target used)
8. LTID (one for each target used, if available)
9. TDRS memory card, programmed IAW Appendix C
10. TDRS computer unit
11. Training area with minimum of 1500 m of maneuver space
12. Moving target with retro reflector unit installed at a range of 500 m

APPENDIX B
TO LESSON PLAN 6

OPERATION OF PGS

SAFETY

The general safety regulations below must be followed during the performance of this lesson. All safety regulations outlined in TM 08594A-10/1A must be strictly followed.

1. Mount and dismount vehicle over the left-front or through the back hatch.
2. Maintain three (3) points of contact while on top of vehicle.
3. Follow unit SOP on smoking near vehicle.
4. Do not go over or under gun barrel.
5. Ensure that TURRET DRIVE LOCK is set to LOCKED.
6. Set vehicle master switch OFF.
7. Turn turret power OFF IAW TM 08594A-10/1A, paragraph 2-56.
8. Ensure that AP and HE feed shaft stop knobs (located on left side of main gun feeder) are pushed in before training. When knobs are out, electrical cables may be snagged and causing damage to vehicle fire control system.
9. No cables should be connected or disconnected by untrained personnel.

APPENDIX C
TO LESSON PLAN 6

OPERATION OF PGS

TDRS MEMORY CARD SETUPS

The TDRS memory card used for the practical exercise portion of this lesson is set up with the following basic data. Each vehicle crew is provided a card prior to practical exercise portion of class.

C-1. SETUP FOR PANEL GUNNERY.

Application:	PGS LAV v1.1
Range:	Select range used
New Ammo:	Yes
First Insert Only:	No
Main Weapon:	
AP Turret:	60 rounds
HE Turret:	150 rounds
AP Hull:	120 rounds
HE Hull:	300 rounds
Load Time:	0 seconds
Upload Time:	10 seconds
COAX Weapon:	
7.62 Turret:	400 rounds
7.62 Hull:	1200 rounds
Upload Time:	10 seconds
Exercise type:	Panel gunnery
Tracer:	
Tracer on:	Yes
Burst on:	Yes
Presentation:	
Audio:	Yes
Control Panel Presentation:	Yes
Firing:	Full scale
Dispersion:	No
User Data:	Input crew data

C-2. SETUP FOR COMBAT MODE (FORCE-ON-FORCE).

Application:	PGS LAV v1.1
Range:	Select range used
First Insert Only:	Yes
New Ammo:	Yes
First Insert Only:	Yes
Main Weapon:	
AP Turret:	60 rounds
HE Turret:	150 rounds
AP Hull:	120 rounds
HE Hull:	300 rounds
Load Time:	0 seconds
Upload Time:	30 seconds
COAX Weapon:	
7.62 Turret:	400 rounds
7.62 Hull:	1200 rounds
Upload Time:	30 seconds
Exercise type:	Combat
Tracer:	
Tracer on:	Yes
Burst on:	Yes
Obscuration:	0 second
Presentation:	
Audio:	Yes
Control Panel Presentation:	Yes
Firing:	Full scale
Dispersion:	Yes
User Data:	Input crew data

C-3. SETUP FOR SCALED GUNNERY.

Application:	PGS LAV v1.1
Range:	Select range used
New Ammo:	Yes
First Insert Only:	No
Main Weapon:	
AP Turret:	60 rounds
HE Turret:	150 rounds
AP Hull:	120 rounds
HE Hull:	300 rounds
Load Time:	0 seconds
Upload Time:	30 seconds
COAX Weapon:	
7.62 Turret:	400 rounds
7.62 Hull:	1200 rounds
Upload Time:	30 seconds
Exercise type:	Panel gunnery
Tracer:	
Tracer on:	Yes
Burst on:	Yes
Obscuration:	0 second
Presentation:	
Audio:	Yes
Control Panel Presentation:	Yes
Firing:	Scaled gunnery
Dispersion:	No
Scale Selection:	1:10 or 1:2
User Data:	Input crew data

C-4. SETUP FOR TRACKING TRAINING.

Application:	PGS LAV v1.1
Range:	Select range used
New Ammo:	Yes
First Insert Only:	Yes
Main Weapon:	
AP Turret:	60 rounds
HE Turret:	150 rounds
AP Hull:	120 rounds
HE Hull:	300 rounds
Load Time:	0 seconds
Upload Time:	10 seconds
COAX Weapon:	
7.62 Turret:	400 rounds
7.62 Hull:	1200 rounds
Upload Time:	10 seconds
Exercise type:	Panel gunnery
Tracer:	
Tracer on:	No
Burst on:	No
Obscuration:	0 second
Presentation:	
Audio:	No
Control Panel Presentation:	No
Firing:	Tracking training
Tracking Time:	20 seconds
Figure of Merit:	1.0 mil
Dispersion:	No
User Data:	Input crew data

APPENDIX D
TO LESSON PLAN 6

OPERATION OF PGS

VIEWGRAPHS